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Effect of different levels of nitrogen, phosphorus and potassium on floral characters of African Marigold (*Tagetes erecta* L.) cv. PUSA NARANGI GAINDA

■ G.R. KISHORE

Author for Correspondence :

G.R. KISHORE

Department of Horticulture, C.C.R.
(P.G.) College, MUZAFFARNAGAR
(U.P.) INDIA

Email : drgrkishore@gmail.com

ABSTRACT : A field experiment was conducted on African marigold with different levels of fertilizer doses *i.e.* 0 g, 11g and 22g of N₂, 0 g, 10g and 20g of P₂O₅ and 0 g, 4 g and 8 g of K₂O/m² at the field of Department of Horticulture, C.C.R. (P.G.) College, Muzaffarnagar (U.P.) during the winter season 2008-2009. Most of the flowering characters were found increased at higher level of N, P and K. By observing the data it can be suggested that 150 kg/ha N₂, 100 kg/ha P₂O₅ and 30 kg/ha K₂O were found suitable dose for the commercial cultivation of African marigold in western plain zone of U.P.

KEY WORDS : African marigold, Nitrogen, Phosphorus, Potassium

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In India various traditional flowers have been growing since time immemorial. Among them marigold has a unique status. Marigold is one of the easiest grown annual flowers and have wide adaptability to different soil and climatic conditions. The plant with their attractive flower colour bloom for a considerably long period and remain fresh for quite a long time after plucking, all these factors have made marigold one of the most popular annual flowers in India for garden display as well as for commercial cultivation.

Nutrients play an important role in the growth and development of any plant. Among nutrients N₂, P₂O₅ and K₂O are of much importance and to fulfill the requirement of plants they are supplied from outside in the form of fertilizers. Nitrogen is a vitally important plant nutrient which impacts good vegetative growth to plants (Arora and Singh, 1980).

Research have been carried out on various economic

floricultural crops to see the effect of these nutrients on their vegetative as well as floral characters. But in marigold, which is a commercially important flower crop in India, very little work has been done so far on nutritional requirement is lacking, keeping in view of these facts, present study was carried out.

RESEARCH METHODS

The experiment was conducted at the experimental field of Horticulture Department in the C.C.R. (P.G.) College, Muzaffarnagar (U.P.) during the winter season 2008-2009. The soil subjected to mechanical and chemical analysis to assess the initial, physical and chemical nature of the soil contained coarse sand 0.55 per cent, fine sand 60.4 per cent, silt 20.2 per cent and clay 16.25 per cent total N (0.10%) available nitrogen (185.7 kg/ha), total phosphorus (0.06%), available phosphorus (28.80 kg/ha), total Potash (0.795), available

Potash (315.00 kg/ha), organic carbon (0.62%), calcium carbonate (1.70%) and pH 7.70. The soil of experiment field was exclusively loam in the texture, deficient in nitrogen and organic matter, moderate in phosphorous and fairly rich in potash having slightly alkaline reactions.

There were 27 treatment combinations comprising three levels of each of N₂, (N₀- 0g/m², N₁ 11g/m², N₂ 22g/m²), P₂O₅, (P₀- 0g/m², P₁-10g/m², P₂ 20g/m²) and K₂O (K₀ - 0g/m², K₁ 4g/m², K₂ - 8g/m²). The experiment was laid out in Factorial Randomized Block Design with three replications. Different fertilizers selected for the application of required quantities of N₂, P₂O₅ and K₂O were Urea (46%), Single Super Phosphate (16% P₂O₅) and Muriate of Potash (60% K₂O), respectively half dose of N and full P and K were applied as a basal dose. The remaining half dose of N was applied after 40 days of transplanting of marigold cv. PUSA NARANGI GAINDA. Data on various growth and flowering parameters were recorded and analyzed statistically as per the method given by Gomez and Gomez (1976).

RESEARCH FINDINGS AND DISCUSSION

First Flowering :

A consistent and significant increase in days to first flowering was observed with increasing levels of nitrogen (Table 1). Maximum days to first flowering were observed with highest dose of nitrogen and statistically significant difference were observed in days to first flowering with different doses of nitrogen (Acharya and Dashora, 2004).

A significant increase in days to first flowering from applied P was recorded with both the levels of P₂O₅ (10g/m² and 20g/m²) with mean values of 74.80 days

and 76.30 (P₁) days (P₂), respectively (Table 1). Application of K upto the highest level K₂O also increased the days to first flowering. It was significantly different from control K₀, whereas K₁ and K₂ were at par with each other. In case of interaction between N, K and P and K same trend was observed. Maximum number of days to first flowering were recorded with highest doses of N and K, P and K. It was further revealed that there was increase in days to first flowering when all the three nutrients were interacting with each other at higher level. Maximum number of days to first flowering (83.65) days were recorded with highest level of all the three nutrients Table 2 (Baboo and Singh, 2003 and Arora and Johan, 1975).

Flower size (cm) :

A perusal of data on flower size (Table 1 and 2) showed that application of nutrients in different doses significantly increased the flower size (flower diameter) over the control. Nitrogen in two different doses had significant effect on flower size as compared to control. It was maximum (6.7 cm) at N₂ level and minimum at control (N₀). An increasing trend in flower size was observed with increasing P level. Both the doses of P applied resulted in the increased flower size compared to control (Bose and Das, 1966 and Baboo and Sharma, 1997).

Table 2 revealed that in case of interaction of N x K and P x K same trend was observed. Highest level of N interacting with K at maximum level and highest level of P interacting with K at maximum level resulted in increased flower size which was recorded 6.47 cm and 6.35 cm, respectively.

Treatments combination		Floral character							
		Days to first flowering	Flower size (cm)	Number of flower per plant	Number of flower at peak flowering	Flower weight/ in (g)	Flower yield / plant(g)	Flower yield/Unit area/ (g/kg/ha)	Flower duration days
Nitrogen	N ₀	71.18	5.82	61.01	17.95	6.37	484.92	205.08	55.72
	N ₁	72.01	6.08	64.24	19.91	7.87	462.01	224.77	57.03
	N ₂	82.23	6.70	72.85	24.54	8.88	650.44	290.11	60.97
Phosphorus	P ₀	74.32	5.80	59.65	17.18	6.14	494.86	240.11	56.79
	P ₁	74.80	6.15	65.45	19.51	7.24	502.05	244.89	57.39
	P ₂	76.30	6.57	71.00	22.86	7.33	600.46	290.85	59.54
Potassium	K ₀	74.05	5.53	61.91	19.58	6.13	507.35	246.84	57.05
	K ₁	75.31	5.91	66.25	20.33	7.38	528.63	256.11	57.91
	K ₂	76.05	6.09	68.24	21.60	7.60	561.40	272.90	58.76
C.D. (P=0.05)		0.54	0.11	0.52	0.46	0.09	6.01	3.03	0.35

Number of flower per plant :

It is apparent from Table 1 that all the treatments significantly increased the number of flowers per plant over control nitrogen at two different levels had significant effect on the number of flowers per plant as compared to control. It was noticed that application of graded levels of K resulted in marked increase in mean flower number per plant (Belorkar *et al.*, 1992).

The Table 2 showed that interaction between N and P found to be much pronounced with respect to number of flowers per plant. The interaction between N, P and K followed the similar trend *i.e.* maximum number of flowers per plant were recorded (Arora and Saini, 1975).

Number of flower at peak flowering :

Increasing levels of N led to an increase in number of flowers at peak flowering. Significant differences in

number of flowers at peak flowering were recorded in case of increasing levels of P. Same trend was also found with the application K. Maximum number of flowers at peak flowering were observed when K was applied at highest level (Chadha *et al.*, 1999).

Flower weight (g) :

The average value with respect to flower weight (Table 1) differed markedly with the application in increasing levels of N, P and K. All the levels of nitrogen had significant effect on flower weight as compared to control. The maximum flower weight was recorded with highest dose of nitrogen. The similar trend repeated in P and K doses (Mohanty *et al.*, 2002).

A perusal of Table 2 shows that the flower weight in marigold increased at all the levels N x P, N x K and P x K when applied together.

Table 2 : Effect of interaction of N, P and K levels of floral characters in marigold

Treatment combination		Floral character							
		Days to first flowering	Flower size (cm)	Number of flower per plant	Number of flower at peak flowering	Flower weight/n(g)	Flower yield / plant(g)	Flower yield/Unit area/ (g/ha)	Flower duration days
NXP	N ₁ P ₁	71.21	5.24	63.54	17.15	6.90	445.40	217.58	56.71
	N ₁ P ₂	73.19	5.70	66.89	19.71	7.41	499.43	241.03	57.53
	N ₂ P ₁	82.14	5.92	69.81	22.64	7.50	591.32	287.76	59.67
	N ₂ P ₂	83.00	7.09	77.70	27.94	8.75	752.71	365.02	62.78
	C.D.	0.54	0.11	0.52	0.46	0.09	6.01	3.03	0.35
NXX	N ₁ K ₁	71.72	5.55	64.04	17.95	6.84	459.05	223.42	56.99
	N ₁ K ₂	72.87	5.70	65.54	18.19	7.00	476.60	231.53	57.37
	N ₂ K ₁	82.24	6.29	71.72	23.80	7.81	635.04	307.76	60.80
	N ₂ K ₂	82.73	6.47	75.29	26.57	8.14	688.19	334.63	61.71
	C.D.	NS	0.11	NS	0.46	0.09	6.01	3.03	NS
PXX	P ₁ K ₁	74.41	5.72	64.44	19.27	7.23	489.46	238.66	57.33
	P ₁ K ₂	75.54	5.93	67.49	20.34	7.41	529.73	258.44	57.93
	P ₂ K ₁	76.47	6.17	70.47	22.57	7.69	593.58	287.04	59.28
	P ₂ K ₂	76.92	6.35	76.66	24.19	7.97	626.09	303.94	60.27
	C.D.	NS	0.11	NS	0.46	0.09	6.01	3.03	NS
NXPXK	N ₀ P ₀ K ₀	64.26	4.12	51.08	16.04	6.03	339.98	162.96	48.83
	N ₁ P ₁ K ₁	70.13	5.96	63.03	17.18	6.90	436.22	214.22	56.80
	N ₁ P ₁ K ₂	72.51	5.36	65.16	17.27	7.03	466.47	227.32	57.20
	N ₁ P ₂ K ₁	73.48	5.85	67.01	19.65	6.59	504.10	241.99	57.37
	N ₁ P ₂ K ₂	74.00	5.88	67.89	20.22	6.81	510.35	245.05	57.91
	N ₁ P ₂ K ₂	82.00	5.93	68.24	22.02	7.50	573.79	278.22	60.12
	N ₂ P ₁ K ₁	82.57	6.06	72.35	24.68	7.86	629.25	306.93	61.88
	N ₂ P ₁ K ₂	83.09	7.10	77.24	27.18	8.66	735.24	356.93	62.11
	N ₂ P ₂ K ₁	83.65	7.42	79.09	30.43	9.03	795.92	386.13	64.03
N ₂ P ₂ K ₂	NS	0.11	NS	NS	NS	6.01	3.03	NS	

NS=Non-significant

Flower yield per plant (g) :

When different doses of N, P and K were applied individually (Table 1) showed that the main value of flower yield per plant increased significantly with the increased level of N, P and K. At higher level of N application when higher levels of P was combined, there was increase in flower yield per plant. Same trend was observed when nitrogen with highest dose of potassium. Maximum flower yield per plant was recorded when highest dose of N was combined with highest dose of P and K (Table 2) (Naveen Kumar *et al.*, 2002).

Flower yield per unit area (g) :

The data showing the effect of N, P and K individually and their interaction on flower yield per unit area are presented Table 1 and 2, respectively. The main effect of N, P and K on flower yield per unit area was found to be positive at all the levels over control. The yield at highest doses of N, P and K was found maximum (386.13 g) (Yadav *et al.*, 2000).

Flowering duration :

Table 1 and 2 revealed that mean flowering duration increased with increasing levels of N, P and K, N when applied to the crop resulted in increasing flowering duration. Highest P dose had much pronounced effect over control compared to lower level of P. The flowering duration was recorded in case of K applied. Flowering duration was found to be increasing by applying increased dose of nitrogen combined with increasing dose of phosphorus and potassium. The maximum flowering duration (64.03 days) was recorded in case of highest doses of all the three nutrients *i.e.* $N_2P_2K_2$ (Yadav *et al.*, 2004).

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